DOCUMENT RESUME

ED 213 855 CE 031 478

TITLE	Marine and Longshoring Safety. Module SH-21. Safety and Health.
INSTITUTION	Center for Occupational Research and Development, Inc., Waco, Tex.
SPONS AGENCY	Office of Vocational and Adult Education (ED). Washington, DC. Div. of National Vocational Programs.
PUB DATE	81
CONTRACT	300-79-0709
NOTE	40p.; For related documents see CE 031 450-507.
AVAILABLE FROM	The Center for Occupational Research and Development, 601 Lake Air Dr., Suite C, Waco, TX 76710 (Instructor Guides, $9.75 each; Learning Modules, $3.00 each. Entire set of Learning Modules available as two subsets: SH-21, SH-41, SH-43, SH-45, and SH-48, $12.00; remaining 45 modules, $97.50).
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Behavioral Objectives; *Health Education; *Learning Activities; Learning Modules; Postsecondary Education; *Safety Education; Safety Equipment; Secondary Education; *Vocational Education
IDENTIFIERS	*Cargo Handling; *Longshore Industry; Marine Equipment; Occupational Safety and Health

ABSTRACT

This student module on marine and longshoring safety is one of 50 modules concerned with job safety and health. This module outlines the requirements for safe operations in the longshoring industry, including procedures for handling cargo. Following the introduction, eight objectives (each keyed to a page in the text) the student is expected to accomplish are listed (e.g., Discuss procedures for handling cargo). Then each objective is taught in detail, sometimes accompanied by illustrations. Learning activities are included. A list of references and answers to learning activities complete the module. (CT)

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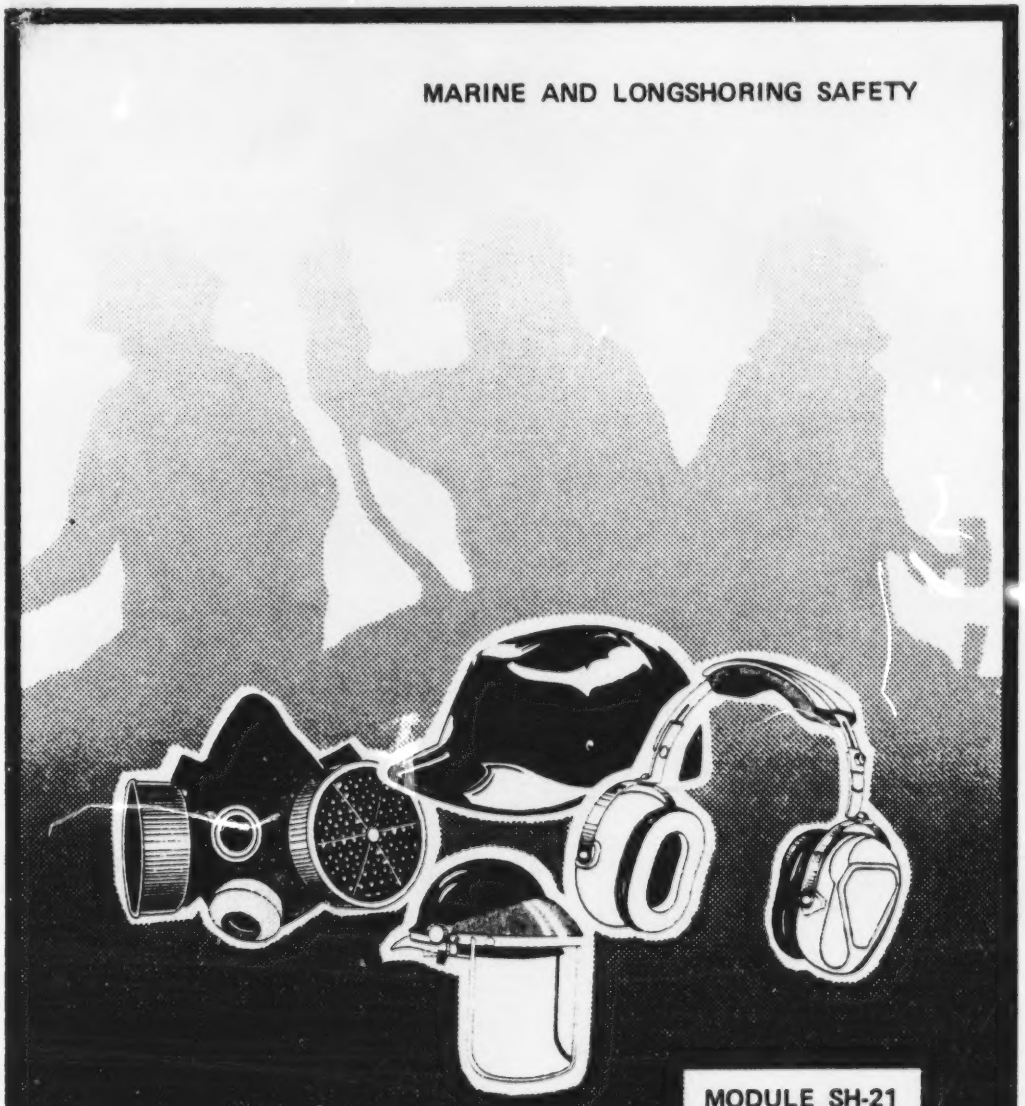
SAFETY AND HEALTH

MARINE AND LONGSHORING SAFETY



MODULE SH-21

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INTRODUCTION

Longshoring, or the loading and unloading of ships at port, is an age old industry. Originally, longshoremen handled cargo through simple manual methods of lifting and carrying. In modern times, there have been changes in ship design and cargo handling methods, but many of the earliest problems and conditions of longshoring still exist, and new hazards have been added.

Longshoring is especially hazardous because of the variability of both the job site and the cargo. The work site can change from day to day and usually is not known to the longshoreman until the day begins. Even access to the workplace involves hazards unknown in other occupations. In some cases, the condition of the ship or barge may be very poor. Remedying unsafe conditions is complicated by the fact that responsibility for these conditions usually belongs not to the stevedoring company that hires the longshoreman, but to the ship's owner or charterer. In addition, longshoremen handle commodities of many different shapes and weights, each requiring a different type of equipment for maneuvering. Hazardous cargoes may include poisonous, corrosive, flammable, explosive, or carcinogenic materials, and each of these cargoes requires special precautions in handling.

All of these factors complicate the matter of safety and health for the longshoreman. This module outlines the requirements for safe operations in the longshoring industry, including procedures for handling cargo and for safety in the use of various types of cargo handling equipment. Maintenance of hazard-free walking and working surfaces is covered, and general health and safety hazards of longshoring are discussed.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Describe the safeguards pertaining to gangways, straight ladders, and Jacob's ladders. (Page 3)
2. List three factors to be considered in the maintenance of safe walking and working surfaces. (Page 6)

3. State the precautions that must be taken around open hatches and on the deck surface to ensure adequate support, guarding, and clearance for longshoremen. (Page 7))
4. Identify four types of equipment that are part of a ship's cargo handling gear and mention one safety precaution associated with each. (Page 13)
5. Discuss safe practices for chains, ropes, slings, and other materials handling equipment. (Page 18)
6. Discuss procedures for handling cargo. (Page 24)
7. Discuss health and safety hazards related to ventilation, sanitation, and general working conditions. (Page 28)
8. List the five types of personal protective equipment required by OSHA. (Page 33)

OBJECTIVE 1: Describe the safeguards pertaining to gangways, straight ladders, and Jacob's ladders.

The first potential hazard of a longshoreman's day is getting to the job site aboard a ship or barge. Unlike the average employee, who reaches work by way of a level surface, the longshoreman must walk up a gangway, climb a straight ladder, or climb a Jacob's ladder to get to the job.

The most common means of access to the ship is the gangway. If a gangway is not practicable, a sturdy straight ladder may be used, as long as it extends 36 inches above the upper landing surface and is secured against slipping or shifting. When neither a gangway nor a straight ladder is feasible, a Jacob's ladder (a rope ladder with wooden rungs for ascending from deck to rigging) may be used.

Figure 1. Gangway.

A gangway (Figure 1) should afford a width of at least 20 inches of walking surface and must be in safe repair at all times.

Each side of the gangway must have a railing at least 33 inches high, measured perpendicularly from rail to walking surfaces. Rails (of wood, pipe, chain, wire or rope) should be kept constantly taut. Portable stanchions (upright posts) that support the railing must be made secure to prevent accidental displacement. Typically, the upper platform of the gangway has a turntable that

enables the gangway to be moved when the ship or barge shifts. This turntable should have guard rails, also.

As cargo is loaded or discharged, the ship will fall or rise in the water, causing the gangway position to shift accordingly. Unless it is kept constantly in trim (alignment), the gangway poses a tripping/falling hazard. The foot of the gangway may sometimes overhang the water between ship and dock. If the gap is wide enough for persons to fall through, a net or other protection must be rigged. When the bottom of the gangway is more than one foot from the edge of the apron (the platform or sill at dock entrance), the space between them will have to be bridged by a firm walkway. This walkway must be equipped with railings of at least 33 inches in height, with midrails on both sides.

When the upper end of the gangway is resting on or is flush with the top of the bulwark (side of the ship above upper deck), secure steps fitted with a handrail of about 33 inches in height must be provided from the top of the bulwark to the level of the deck.

Obstructions must never be placed on or across the gangway. Unless the ship's design is prohibitive, the means of access should be located so that drafts of cargo do not pass over it. Under no circumstances should loads be passed over the access while employees are using it. Supporting bridles (hoisting slings or wire that help support the gangway) must be kept high enough to prevent head injury, and at no time should they obstruct the passage of employees using the gangway. The gangway must be well illuminated for its full length.

When a fixed-tread gangway is at a very low angle, requiring employees to walk on the tread edge, a cleated "duck-board" should be laid over the treads and secured. A duckboard is a kind of boardwalk, and the cleats provide a brace for the feet to push against.

There are instances, such as getting onto barges, when a Jacob's ladder must be used. Because a Jacob's ladder is not rigid, it must be securely attached, without slack, to the bulwark or the deck fittings (which may be cleats, rings, stanchions, and so on). Rungs must be of the flat-tread (double-rung) type for optimum footing. The former style of single "broomstick" rung ladders is no longer permitted.

For access to barges and river towboats, ramps of sufficient strength to support vehicles are commonly used. The ramps should be fitted with reliable side boards along the space to be bridged. If employees cannot step safely to or from the wharf, (float, barge, or river towboat), a safe walkway must be provided. A sturdy straight ladder can be used if necessary. If conditions prohibit the use of either a walkway or a straight ladder, a standard Jacob's ladder will serve.

When a barge, raft, or log boom is being worked alongside a larger vessel, a Jacob's ladder should be provided for each gang working alongside, unless other safe means of access are available. In longshoring operations involving barges and vessels, the barges should be made fast to the vessels.

Access must be provided for workers getting in and out of the lower hold and "tween decks." At least one safe and handy ladder should be provided for each gang working in a hatch. Vertical fixed ladders should have an adequate means of gaining a handhold at the top. Covers to ladder hatchways should be secured so that they will not close inadvertently. There should be a clearance of four inches behind the rungs of a fixed ladder.

When fixed ladders are blocked by cargo, or do not meet the requirements of the paragraph above, portable straight ladders extending at least 36 inches above the coaming (the curb around the hatchway) should be substituted. If a straight ladder cannot be used, the gang must rely on a Jacob's ladder. Steps formed by the cargo itself are permissible if the nature of the cargo allows.

ACTIVITY 1:*

1. List three possible means of access to a ship or barge:
   a. _____
   b. _____
   c. _____
2. What causes the gangways to shift position?
   _____
   _____

*Answers to Activities appear on page 36.

3. Which of the following is not a requirement for means of access in and out of hatches?

   a. At least one safe and handy ladder must be provided.

   b. There should be a clearance of four inches behind the rungs of a fixed ladder.

   c. Portable straight ladders must be long enough to extend 36 inches above the coaming.

   d. Cargo may never be used as a means of access.

OBJECTIVE 2: List three factors to be considered in the maintenance of safe walking and working surfaces.

Good housekeeping aboard plays a major role in the safety and health of longshoremen. With drafts of cargo constantly coming and going, the ship could easily become knee-deep in debris.

All walking and working areas should be kept reasonably clear; the weather deck should be kept as free as possible from lines, bridles, dunnage (padding for cargo), and all other loose gear. Gear and equipment not in use should be cleared away or placed where they will not be a threat to safety. Slippery conditions must be eliminated as they occur; loose paper and trash should be collected as work progresses.

If dunnage interferes with free movement of cargo drafts, it should not be placed on deck at all. Dunnage racked against sweat battens cannot be used if the rack levels are beyond the reach of the longshoremen. When not in use, dunnage, hatch beams, tarpaulins, and gear should be stored no closer than three feet to the port and starbroad sides of the weather deck hatch coaming. A reasonable tolerance is permitted, however, if circumstances make this regulation unfeasible. Nails protruding from shoring or fencing in immediate work areas must be bent over or otherwise made harmless. This rule also applies to nails protruding from dunnage or lumber. During freezing conditions, the employer must see that longshoremen are not exposed to accumulated ice that could fall from aloft, causing injury.

Illumination of all walking/working areas is required. Portable lights must have substantial reflectors and guards to prevent flammable materials from coming in contact with the bulb. Guards are not required if the reflector is designed so that the bulb may be deeply recessed.

Portable lights must have heavy-duty electric cords and may be suspended by the cord if electrical parts are not strained by doing so. Connections and insulation should be in safe condition. Lighting wires and fixtures must be arranged in such a way as to be free from contact with drafts, running gear, or other moving equipment. Lights should always be placed so they will not shine in the eyes of winch drivers or hatchtenders. Portable cargo lights furnished by the employer and purchased after September 1, 1966, must be listed as approved by the U.S. Coast Guard, or must bear the marine label of the Underwriters' Laboratories, Inc.

No employee may enter dark holds, compartments, decks, or other unlit places without a flashlight or similar portable light. The use of matches or of open flame is prohibited.

ACTIVITY 2:

Name three factors to be considered in the maintenance of safe walking and working areas.

1. _____
2. _____
3. _____

OBJECTIVE 3: State the precautions that must be taken around open hatches and on the deck surface to ensure adequate support, guarding, and clearance for longshoremen.

The opening of hatches is one of the first responsibilities related to cargo loading and unloading. On most modern ships, the hatch opening and closure is handled by the ship's crew with the aid of hydraulic or mechanical

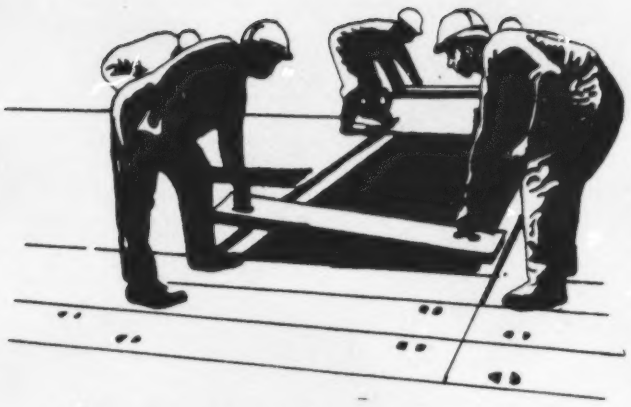

Figure 2. Two longshoremen removing hatchboards.

systems. The old-style beams, boards (see Figure 2), and pontoon-type hatch covers are still in use on some older vessels, and these have a relatively great hazard potential. Important things to consider in regard to hatches are the soundness of the working surfaces, the protection from falling that is afforded by coamings (curbs around the hatch), railings, taut lines, or nets, and the amount of clearance for working around open sides and/or stacked cargo. The key words here are support, guarding, and clearance.

Hatches, in which ship's cargo is stored, must be braced with beams, and covered. Cargo, dunnage (padding or loose materials around cargo), and other material must not be loaded or unloaded by employees at any partially opened intermediate deck, unless —

- The hatch at that deck is sufficiently covered.
- A landing area suitable for prevailing conditions exists.

In no event should such work be attemped unless the work area available to employees extends 10 feet or more fore and aft (front and back) and athwartships (horizontally across the ship).

Cargo (see Figure 3) cannot be landed or handled on a covered hatch unless all hatch beams are in place under the hatch covers. Missing, broken, split, or poorly-fitting covers are a threat to workers' safety and must be reported at once to the ship's officer in charge. Until replacement or repairs have been made by those in charge of the vessel, employees may not work in the hazardous sections.

Small "trimming hatches" must be covered or guarded while work proceeds in the largest hatch that houses them. (Trimming means distributing the cargo weight properly; trimming hatches are openings pierced in intermediate decks for trimming dry gain bulk cargoes.)

Temporary platforms upon which loads are landed should be sufficiently large and stable to accommodate employees working on top of them.

Figure 3. Cargo.

An edge of hatch section or of stowed cargo more than eight feet higher than the level below may become so exposed as to create a danger of falling. In this event, the edge must be guarded by a safety net.

Employees are forbidden to pass fore and aft, over or around deck loads unless there is a safe passage. Signalmen are not permitted to walk over deck loads from rail to coaming without safe passage. Any signalman who must stand at the outboard or inboard edge of a deck load with less than 24 inches of bulwark, rail, coaming, or any other protection, must be suitably guarded in some way against falling from the deck load.

When working around open weather deck hatches, longshoremen should be protected by coamings to a height of 24 inches. Otherwise, taut lines at a height of 36 to 42 inches above the deck should be provided, except on the side where the cargo is being worked. Portable stanchions (upright posts) are generally used to secure the lines. These removable weather deck rails must be kept in place except when cargo operations necessitate their removal. They should be replaced as soon as operations are completed. (The requirements of this section do not apply to barges or to the Great Lakes type of bulk carrier.)

Employees are not allowed to walk along the sides of covered lighters (light ships) or of barges with coamings more than five feet high, unless there is a three-foot clear walkway, grab rail, or taut handline. It is also prohibited to walk or work on the decks of barges waiting to be loaded, until

and unless the walking/working surfaces are seen to be structurally sound. If in the course of unloading a barge an unsound deck surface is found, work must be discontinued until temporary provisions are made to make that surface safe, or to avoid it altogether.

Decks that have been freshly painted or oiled are off-limits for longshoring operations. The employer must not allow work to continue until essential walking/working areas have been made safe by the use of nonskid materials.

If a deck load of lumber or other smooth-sided cargo over five feet high is stowed within three feet of the hatch coaming, those workers handling beams and hatch covers must be protected by at least 24 inches of coaming height. Otherwise, a taut handline along the side of the deckload is necessary for protection.

Before intermediate deck hatch beams and covers are removed or replaced, there must be:

> a three-foot working space between stowed cargo and the coaming at both sides and at one end of the hatches, with athwartship beams. This working space must also be provided at both ends of the hatches, with fore and aft beams.

However, reasonable tolerance is permitted where a three-foot working space would create undue hardship. The three-foot clearance requirement is not necessary on the covered portion of a partially-opened hatch, nor is it required when lower decks have been filled to beam height with cargo that, by its very nature, provides a safe working surface.

When bulkheads (partitions that separate compartments), lockers, reefer compartments (refrigerated compartments), or large spare parts are within three feet of the coaming, grab rails or handlines must be provided to protect employees handling beams and hatch covers. The provisions on coaming clearances in this section do not apply to hatches that are opened by hydraulic or other mechanical means.

Beam and pontoon bridles (lengths of cable, shown in Figure 4) must not be used unless they are long enough to be within easy reach of the holes, rings, or other lifting attachments on these items. Bridles should be well

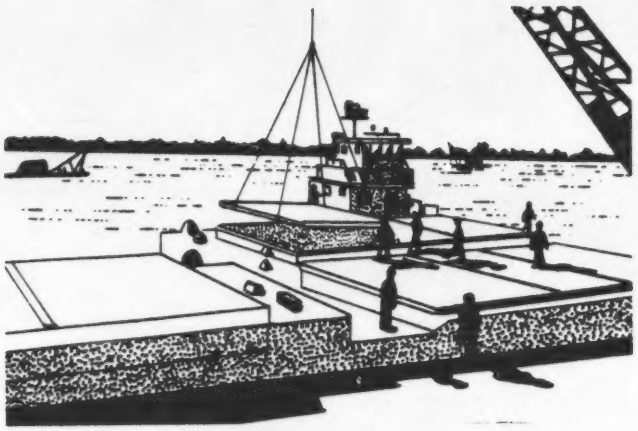

Figure 4. Bridle lifting pontoon-type hatch cover.

cared for, and protruding ends in wire rope splices should be blunted.

Bridles for lifting hatch beams must have toggles (devices for securing), shackles, or hooks designed to prevent dislodgement from the beams. Toggles should be at least one inch longer than twice the longest diameter of the holes in which they are to be placed.

The pontoon-type of hatch cover (Figure 4) differs from the fold-back type in that it is a rectangular box unit fitting into shoulders inside of the coaming. Bridles used in lifting pontoons must have the required number of "legs" (the chains or rope actually connected to the load). When the use of a bridle requires fewer legs than the number provided, unused legs should be hung on a hook or a ring to prevent them from swinging free. At least two legs of all strongback (a type of beam) and pontoon bridles should be equipped with a stout fiber rope lanyard no less than eight feet long and in good condition. The bridle end of the lanyard may be of chain or wire.

The pontoon-type covers are lifted out and placed on the deck or pier, depending on space availability. If hatch covers and pontoons are stowed on the weather deck abreast of hatches, they must be:

- Arranged in stable piles no closer than three feet from the hatch coaming, and
- On the working side of the deck, no higher than the coaming, unless
- The covers are spread one-high between the coaming and the rail, with no space between them, and with not less than 24 inches of coaming height.

When requirements of the above section cannot be met, due to the narrowness of the deck area, pontoons may be stored more than one-high against the coaming as long as:

- A 24-inch height of hatch coaming is maintained on the working side of the vessel.

If the pontoons must be stowed closer than three feet to, and higher than, the coaming on the idle side, they will have to be secured against movement.

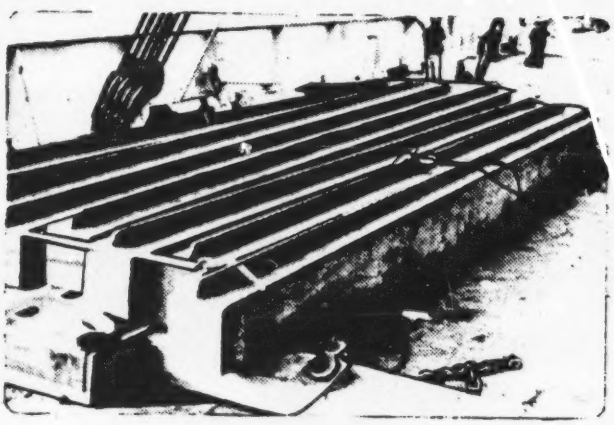

Figure 5. Hatch beams (strong-backs) stacked on deck, lashed with wire ropes, and fiber ropes.

Hatch beams are handled by laying them on their sides or standing them upright, close together and lashed. (See Figure 5.) The covers and pontoons must be placed so they will not interfere with a safe walkway from rail to coaming, or fore and aft. They must be secured against the possibility of tipping over, or of being dragged into hatches or even overboard by cargo drafts. Dunnage or other suitable materials should be used under and between tiers of strong-backs and pontoons, since metal against metal will slip.

If a beam or pontoon is left adjacent to the section through which cargo, dunnage and equipment is being worked, the beam/pontoon must be securely lashed. All portable (manually handled) hatch covers must be removed from any working section.

The roller hatch beam at the edge of the hatch's open section must be lashed or pinned back so that it cannot move toward the open area.

The proper coverings for hatches are the standard covers, or night tents made of heavy canvas. Hinged or folding hatch covers are normally stowed in an approximately vertical position and must, therefore, be well secured.

ACTIVITY 3:

1. Which of the following is the best summary of what must be considered in ensuring safe walking and working surfaces for longshoremen?
   a. Pontoon bridles, coamings, and clearance.
   b. Support, guarding, and clearance.
   c. Securing of hatch beams, strength of hatch covers, and guard rails.
   d. All of the above.
2. List two regulations for stowing hatch covers and pontoons.
   a. _____
   b. _____

OBJECTIVE 4: Identify four types of equipment that are part of a ship's cargo handling gear and mention one safety precaution associated with each.

The cargo handling gear of a ship is subjected to various stresses and strains while being used during longshoring operations. The fundamental cause of gear failure in hoisting cargo is two-fold: the lack of safety devices to prevent overloading the gear, and the lack of knowledge needed to determine when the gear is being overloaded. By knowing how to rig properly, by knowing the lifting capacity of the ship's gear, by knowing the weight of the object to be lifted, and by establishing inspection procedures to check all of these factors, failure of the ship's cargo-handling gear can be prevented.

Before the loading or discharging operations begin, there must be a complete visual inspection of the ship and its cargo-handling gear. The ship's cargo gear register and certificates must be checked. The entries for the last quadrennial survey and the last annual survey must be examined.

Ship's cargo-handling gear includes a number of pieces of equipment designed to move cargo efficiently and safely. Preventers are the wire ropes

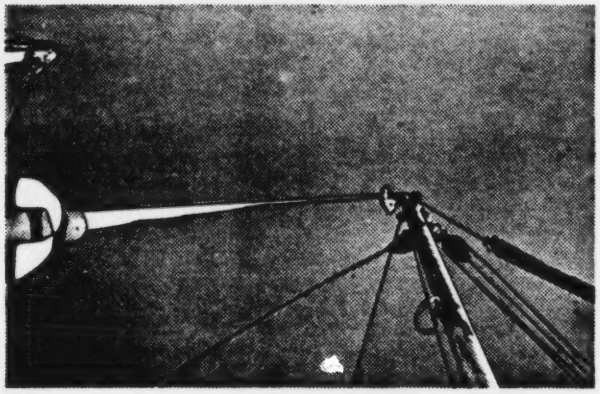

Figure 6. Preventers are secured to the head of the boom, independent of working guy lines.

for holding the boom in place and must be secured to the head of the boom, independent of working guy lines (Figure 6). Manila taglines (tails), fittings, or other means of making preventers fast on deck must provide strength equal to the strength of the preventer itself. Wire ropes, clips, or knots must never be used to make eye splices in, nor to join sections of preventers. Guys (other cables) and preventers should be as nearly parallel as possible, and should be adjusted to share the load.

Topping lift stoppers, made of chain, are equipped with manila tails and are long enough to allow three half-hitches in the chain. The stoppers are shackled in a manner that will prevent bending of the links as they pass around fittings. The point of attachment should be located so that the stoppers are in line with the normal topping lift lead at the time the stopper is applied. Clamp-type patent stoppers must be suited to the size of rope used.

Figure 7. The end of the winch fall must be secured to the drum by clamps, U-bolts, or shackles — not fiber rope fastenings.

Falls are wire ropes leading from a winch on deck through a heel block at the base of the boom, and through a head block at the top of the boom, and then to the cargo hook. The end of the winch fall (Figure 7) must be secured to the drum by clamps, U-bolts, or shackles — fiber rope fastenings cannot be used. Design permitting, the fall should be wound on the drums of the winch so that the control mechanism

moves in the same direction as the load.

With the exception of eye splices (Figure 8) at the ends of wires, each wire rope used in hoisting or lowering must consist of one continuous piece without splice or knot. This rule also applies to wire rope used in guying derricks, or as a topping lift or preventer.

Figure 8. Eye splice.

When employees are working in the recess formed by the heel block, or bight, a preventer of at least 3/4-inch diameter wire rope must be rigged to hold the block and fall, in case heel block attachments should fail (see Figure 9). If the heel block is less than 10 feet above the deck and is not rigged to prevent its falling, it should be secured to prevent alternate rising and dropping of the block.

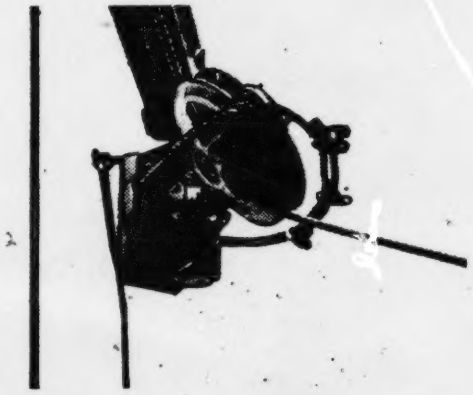

Figure 9. Preventer to hold the block and fall.

Cargo hooks must be placed as close to the junction of the falls as the assembly permits — never farther away than two feet.

Cargo winches may be operated by steam or electricity. A steam winch is governed by the following regulations:

- Every effort must be made to prevent escaping steam from obsuring decks or other work places.
- Access to the steam valve must be maintained between each winch and the deck steam line.
- Extension control levers that tend to fall of their own weight should be counterbalanced.
- When winches are left unattended, control levers should be secured in neutral.

An electrical winch is governed as follows:

- When the electromagnetic or other service brake is unable to hold the load, the winch must not be used.
- Also, the winch must not be used if one or more control points, either hoisting or lowering, is not operating properly. Employees must not tamper with or adjust electrical circuits.
- When left unattended, the winch's control levers must be placed in neutral with the power shut off and/or the control levers locked.

Among the requirements for rigging gear, there are several that involve guylines. If there is a choice of positions in which to secure the guys, they should be placed so as to produce minimum stress without permitting the boom to jackknife. The head of the midship boom must be located no farther outboard of the coaming than is necessary to control the load.

Preventers, if used, are secured to fittings of their own that must be as nearly parallel to the guy fittings as possible. The only exception to this is the situation in which the preventer is working in place of the guy, and the guy is designed for trimming purposes only. In these cases the guy lines should be left slack.

Failure of the topping lift is rare, but it can occur when the boom is in a low, or close to horizontal, position.

A very common type of rigging, known as the "union purchase," is subject to gear failure under certain circumstances. In this rigging situation, the load is shared by falls which are connected to two different booms. The wider the angle between each fall, the greater the tension on each fall. Specifically, when the angle is greater than 120°, the stress on each fall is greater than the weight of the load being lifted. As the downward pull on each fall works to pull the heads of the two booms together, the guy and preventer wires counteract this tendency. Care must be taken that the angle remains narrow enough to prevent gear failure.

Cargo falls (lines) under a load must not be permitted to rub against other running or standing rigging.

"Bulling" refers to the horizontal dragging of cargo across a surface with none of the cargo's weight supported by a fall. When a bull wire is taken to a gypsy head (a small auxiliary drum at the end of a windlass or a

capstan, for line handling) in order to lower or top a boom, the wire should be secured to the head by shackling. Rope fastenings are inadequate. If it is not possible to secure the wire to the gypsy head, at least five turns of the wire must be taken.

When deck loads extend above the rail and there is less than eight inches of horizontal clearance between the edge of the deck load and the inside of the bulwark or rail, employees may not use that clearance without adequate precautions against falling.

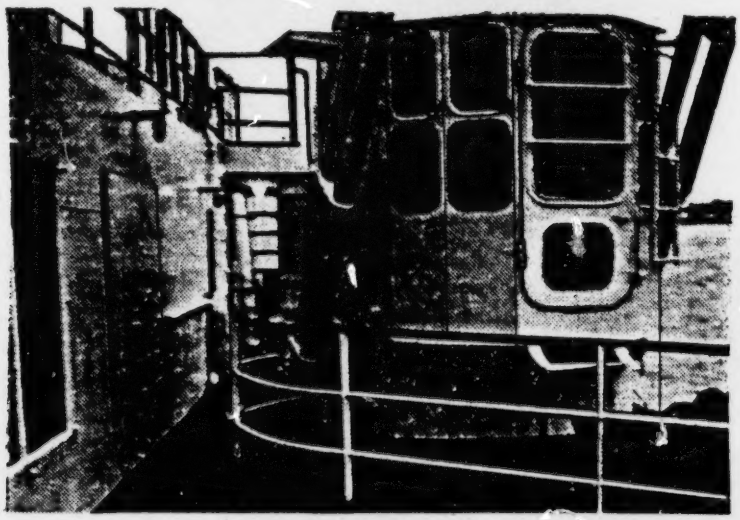

Figure 10. Body of crane and area in its swing radius is guarded.

Cranes are subject to strict safety rules. The accessible areas within the swing radius of the outermost part of a revolving crane must be guarded. This guarding is to prevent employees from being caught between the body of the crane and the fixed parts of the vessel (Figure 10).

ACTIVITY 4:

(Fill in the blanks.)

1. Wire ropes used in hoisting, guying, or as preventers must be _____.
2. The end of the winch fall must be secured to the drum by _____.
3. When winches are left unattended, control levers _____.
4. In "union purchase" rigging, the wider the angle between each fall, the greater _____ _____.

OBJECTIVE 5: Discuss safe practices for chains, ropes, slings, and other materials handling equipment.

Before each use, all gear and equipment provided by the employer — that is, cargo-handling gear and equipment other than ship's gear — must be inspected by the employer or by an authorized representative. Gear found to be unsafe must be made safe, or discarded.

Any article of stevedoring gear hoisted by ship's gear and weighing in excess of 2,000 lbs must have the weight marked plainly on it. Special stevedoring gear that employs components other than commonly used stock items should be tested, as a unit, before use. If gear is intended to handle lifts up through 20 short tons (40,000 lbs), it must be tested to 25% in excess of its working load. For lifts over 20 short tons but not exceeding 50 short tons (100,000 lbs), gear should be tested to five short tons (10,000 lbs) in excess of the safe working load.

A record of the dates and results of the tests must be maintained by the employer. The records are subject to examination by representatives of OSHA (Occupational Safety and Health Administration).

ROPES, CHAINS, AND SLINGS

The use of fiber rope and fiber rope slings is regulated by OSHA, also. The safe working load of various sizes of manila rope and rope slings is mathematically determined. However, higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products, PROVIDED that a safety factor of not less than five is maintained. The safety factor of five means that the rope must be capable of handling five times the weight actually involved.

If synthetic fiber ropes are substituted for manila ropes of less than three inches' circumference, the substitute must be of equal size. If substituted for manila ropes of more than three inches' circumference, the size of the synthetic rope must be determined by formula. When a substitution is being made, the fact that the inherent characteristics of the synthetic are suitable for its intended use must be ensured.

Wire ropes and wire rope slings are subject to stress, just as are fiber ropes. Protruding ends of strands in wire rope splices must be covered or blunted. Wire rope should not be secured by knots except on haulback lines on scrapers. Wire rope should never be used to handle cargo if in any length of wire rope that is eight times the diameter of the rope, the number of visible broken wires exceeds the total number of wires. Wire rope should never be used if the rope shows other signs of excessive wear, corrosion, or defect.

The safe working loads of various-sized wrought iron and alloy steel chains are mathematically determined, but these chains must always have a safety factor of five. Higher safe loads are permissible for specific products, on the recommendation of the manufacturer. Proof coil steel chain (hardware chain) is not recommended by the manufacturer for slinging or hoisting, and must not be used in hoisting operations.

All sling chains, including end fasteners, must be visually inspected before and when necessary during each use on the job. A thorough inspection of all chains should be made every three months to detect signs of wear, defective welds, deformation, and increase in length or stretch. Interlink wear must be noted and the chain removed from service when maximum allowable wear at any point of linkage has been reached. A load must not be lifted by a chain that has a kink or knot in it. Attempts should never be made to shorten a chain by bolting, wiring, or knotting.

SHACKLES

Shackles are fastening devices of various shapes, with an open or closed link and extended legs. Each leg has a transverse hole for pin or bolt. The safe working load of various-sized shackles is also mathematically determined, with the usual exception that higher working loads (with a safety factor of five) are permissible as recommended by the manufacturer.

HOOKS

Manufacturer's recommendations are to be followed in determining safe working loads of the several types of hooks used in handling cargo. Hooks for which there are no appropriate recommendations must be tested to twice

the intended safe working load before they are used. The employer is responsible for recording the dates and the results of these tests.

Loads should be applied to the throat of the hook, since the hook can become bent out of shape if loaded at the point. There should be periodic inspection of all hooks to weed out those that have been bent or sprung by overloading.

Teeth of case hooks must be maintained in good condition. Jaws of patent clamp-type hooks should be maintained so they will grip the plate securely.

PALLETS

Pallets (portable platforms for storage/transportation of goods) must be constructed so they can safely support and carry the loads that are handled on them. Reusable pallets are fastened by bolts and nuts, drive screws (threaded nails), or fastenings of equal strength.

Figure 11. Wing pallet is loaded on to bar bridle.

Wing or lip-type pallets hoisted by bar bridles (Figure 11) must have an overhanging wire (or lip) at least three inches long.

When, upon inspection, loaded pallets do not meet requirements, they should be placed on pallets that do meet requirements before being hoisted into or out of the vessel. Bridles used to handle flush-end or box-type pallets must be of a design that prevents them from being pulled away from the pallet under the load.

CHUTES, ROLLERS, AND CONVEYORS

Chutes used in manual handling of cargo must be long enough and strong enough for their intended use, and must be kept free of splinters and sharp edges. The sideboards of chutes must be high enough to prevent cargo from falling off.

Gravity rollers should have sufficient strength for the weight of the material placed upon them. Rollers must be locked into position to prevent them from falling or jumping off the frame. Frames themselves must be kept free of burrs and sharp edges. When necessary for safety, provision must be made for braking cargo loads at the delivery end of the roller or chute.

Readily accessible stop controls are necessary on power conveyors in case of emergency. Whenever employees must work in the vicinity of a conveyor, its controls must be manned as long as the machine is running.

GRAIN TRIMMING MACHINES AND OTHER ELECTRICALLY POWERED EQUIPMENT

Electric motors and controls on grain trimming machines (machines to distribute the grain) should be explosion proof (as approved by the Underwriters' Laboratories, Inc.) for use in hazardous locations. All conveyor and trimmer drives that create a threat must be well guarded.

Each grain trimmer should have a control box located on the weather deck in close proximity to the grain spout feeding the trimmer. Power cables between the deck control box and the trimmer must be used only in continuous lengths, without a splice or a tap between connections.

Portable cargo stowing winches can be used only with the knowledge and the consent of the officer in charge of the vessel. Such winches must be secured against shifting at all times.

When internal combustion-powered stowing winches are located below the weather deck or in other enclosed spaces, the exhaust must be led topside to open air and away from the hatch opening.

When rain tents are used, lanyards must be secured to padeyes or to any other strong fixed structures of the vessel. Alternatively, lanyards must be secured to objects heavy enough to withstand the breaking stress of all lanyards attached.

Portable and electric hand-held tools are equipped with switches of a type that must be manually held in a closed position. Portable power-drive circular saws must have guards above and below the base plate or shoe.

- The upper guard must cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts.
- The lower guard must also cover the saw to teeth depth, except for the arc that allows proper retraction and contact with work.

When the saw is withdrawn, the lower guard must instantly and automatically return to the covering position. Any person working with or near a saw must be very careful.

MECHANICALLY-POWERED VEHICLES

Mechanically-powered vehicles used aboard vessels must adhere to safety regulations, too. Overhead guards for fork lift trucks must be firmly attached to the machines. The guards are designed to protect operators from items of cargo that may fall from the load, or from stowage.

The overhead guard must be:

- Constructed so as not to interfere with visibility; however, openings in the top cannot exceed six inches in width or length.
- Large enough to extend over the operator in all normal operating procedures, including forward tilt.

This guard may be removed only when its presence prevents the truck from entering working spaces, or subjects the driver to injury from low overhead construction.

Crawler-type rider operated bulk cargo-moving vehicles are required to have guards that will protect seated operators from overhead injuries. Guards and their attachments must be able to withstand a load, applied horizontally at shoulder level, equal to the drawbar pull of the machine. If there is no danger from overhead, guards are not required. An end platform guard must be used on trucks operated from an end platform or pedal position. The guard must allow rapid and unobstructed egress.

All mechanically-powered vehicles that are lifted aboard vessels must have their weights, with and without counterweights, clearly posted. Loads

in excess of the rated capacity must not be lifted or carried by lift trucks. The operator should make sure that the working surface can support vehicle and load, and that hatch cover, truck plates, and so on cannot be dislodged by the motion. NO load on a lift truck or crane truck may be suspended or swung over an employee.

When mechanically-powered vehicles are being used on open deck barges, the edges of the vessels must be guarded by railings, sideboards, timbers or any other means of preventing the vehicles from rolling overboard.

CRANES AND DERRICKS

Cranes and derricks other than vessel's gear are sometimes moved on board to aid in loading and unloading. The weight of a mobile crane hoisted aboard must be posted on the crane itself. All types of cranes should have a rating chart. This chart should cover the entire range of manufacturer's capacity ratings including operating radii for permissible boom and jib lengths as applicable, and with and without outriggers that may be fitted. A boom angle or radius indicator may be used. The rating chart must be clearly visible to the operator, and an explanation of operating controls should be posted at the operator's position. If barges, rail cars and cargo are carelessly handled, side loading stresses upon the crane will cause damage. No crane or derrick displaying a visible defect should be used.

ACTIVITY 5:

Mark each item true or false.

_____ 1. All sling chains must be visually inspected before each use.

_____ 2. Hooks should be loaded at the point.

_____ 3. Wing or lip-type pallets should have an overhanging lip of at least three inches.

_____ 4. One hazard associated with grain trimming machines is explosion.

_____ 5. One hazard associated with internal combustion-powered stowing winches is exhaust fumes.

_____ 6. Side-loading stresses can be caused by careless handling of the crane or derrick.

OBJECTIVE 6: Discuss procedures for handling cargo.

Actual moving of cargo requires either muscle, horsepower, or mechanical means. The problem of overloading gear was discussed earlier in the module. It is important that people refrain from overloading themselves, too. Employees should be aware of proper lifting procedures in order to avoid back injuries. Besides slips, trips, and falls, injuries associated with cargo handling are generally caused by physical strain when moving cargo by hand or when positioning loads, or by dropped, swinging, or falling objects. The cargo and gear must be reasonably secured and controlled against the possibility of dropping objects. Constant attention to moving loads is necessary. It is a basic rule of the longshoring industry that loads are not hoisted over exposed employees, and that employees are never to stand under a load (Figure 12).

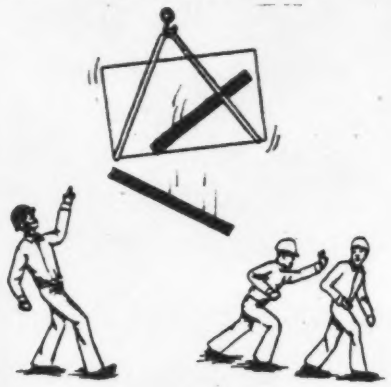

Figure 12. Longshoremen are never to stand under a load.

Cargo drafts must be safely slung before hoisting, with no loose dunnage or debris hanging from them. That is, slings must be placed around the cargo so there are no loose pieces. Handling bridles that are to remain attached to the hoisting gear during successive hoists of draft must be attached by shackles. Such attachment will prevent bridles from becoming accidentally disengaged from the cargo hook. Drafts or lumber, pipe, and dunnage, the top layer of which is not bound, must be slung in a way that will prevent sliding. Unstrapped dunnage should be double-slung unless the size of hatch or deep-tank openings make it impossible. Case hooks may not be used for handling cases into or out of the vessel, unless the cases are specially designed for such handling.

Loads requiring continual manual guidance must be provided with taglines. No draft can be hoisted unless the winch or crane operator is able to see

(a) the draft itself, or (b) the signals of a signalman involved in the operation. Cargo drafts can be built in such a way that the cargo does not come loose from them. Hand-loaded buckets or tubs being packed with cargo should never be filled above the rims.

Stowed cargo should be secured and blocked as necessary to prevent shifting and/or falling. In breaking down (removing drafts from stowage), precautions should be taken to prevent the remaining cargo from falling.

Employees trimming bulk cargo (that is, distributing its weight), should be checked in and out by the foreman. A reefer (refrigeration) compartment should never be secured until it is certain that no employees remains inside. Constant checks must be made for the safety of a longshoreman working alone in a tank or cargo compartment. This requirement is designed to protect persons from being buried or lost in bulk pouring operations, or from being suffocated in a reefer compartment.

Bulling cargo is done with the bull line led directly from the heel block. Bulling may also be done from the head of the boom under certain circumstances:

- When the nature of the cargo and the surface over which it is dragged will not stall the load.
- When the winch does not have sufficient strength, with the purchased used, to overload the boom.

To provide a fair lead for the bull line, "snatch blocks" are routinely used. These blocks help prevent unnecessary dragging of the bull line against coamings and obstructions. Snatch blocks should not be used with the point of the hook resting on the flange of a beam, but they must be hung from padeyes, straps, or beam clamps. Beam or frame clamps should be secured to the beam against the possibility of the beam's slipping or falling. In many instances, using a forklift can be substituted for bulling the cargo.

A "container" as used in handling cargo, means a rectangular, reusable container of rigid construction, intended for holding articles of cargo for shipment aboard a vessel. (See Figure 13.) On every cargo container there must be permanently marked in pounds:

- Its weight when empty.
- The maximum cargo weight it is intended to carry.
- The sum of the above two weights.

Containers may be loaded or discharged from a vessel by means of ship's cargo handling gear, or by shore crane or derrick under the following conditions.

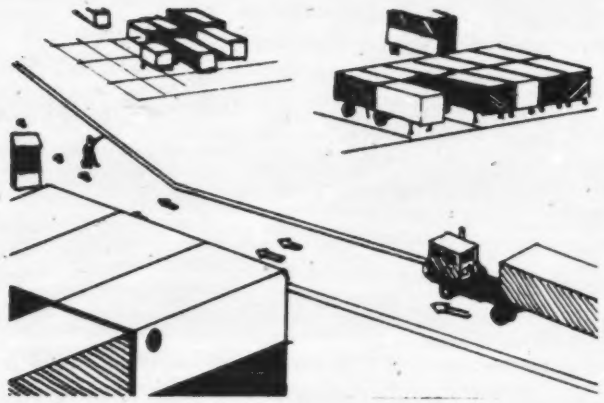

Figure 13. Containerized cargo.

An empty container must be designated as such by the carrier and identified by marking, or in the cargo stowage plans. This marking is to indicate to every supervisor, foreman, crane operator, and signalman that the container is empty.

A loaded container must show the actual gross weight so that it is visible to the crane operator and to the signalman. Everyone concerned in the loading or discharging operation must be able to know the weight, the exact stowage position, and the serial number, or some other positive identification of that specific container.

Outbound loaded containers received at a marine terminal, ready to load aboard a vessel, must first be weighed to obtain gross weight. If there are suitable weighing scales at the terminal, weight is determined on the spot. When weighing is inappropriate, or no scales are available, the container's actual gross weight may be calculated, provided that:

- A list of the weights, including the empty container weight, is totalled.
- The list is posted conspicuously on the container with identification of the source and date of calculation.

Container weights arrived at by calculation will be subject to random sample weight checks at the nearest facility. When such checks indicate consistently inaccurate weights, the weights may no longer be recognized as true gross weights. The containers are then prohibited from going aboard until gross weights have been obtained on functioning scales. The OSHA compliance officer can continue the procedure until he or she is satisfied that correct weights have been furnished.

Loaded inbound containers from foreign ports, if they have not been weighed, must have the calculated weight posted as in the above paragraph. Such containers are also subject to random sample checks by OSHA until the administrator is satisfied.

No container will be hoisted if its actual gross weight exceeds the weight of the container when empty, plus the maximum cargo weight intended by the designer. Outbound containers must be inspected before loading for structural defects that would create safety hazards in loading. A container found to have such a defect must not be loaded unless the flaw can be corrected. To the extent practicable, inbound containers should be similarly inspected. A defective inbound container must be discharged by special safety measures or must be emptied before discharge.

Before cargo handling operations begin, an employer's representative is required to find out what dangerous cargoes (if any) are to be handled. The general nature of the hazard must also be determined. The information is available through cargo labels, dangerous cargo manifests and other shipping documents. The employees must then be informed of the hazard, of the importance of preventing damage to the cargo, and of the special precautions that must be taken (Figure 14). The employer's representative will instruct that any leaks or spills be reported.

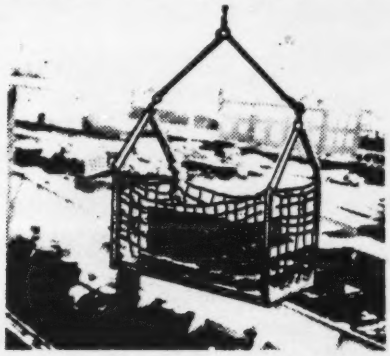

Figure 14. "Dangerous cargo" in net.

Drafts of cargo found to be hazardous require the utmost care when it comes to slinging. Neither the draft itself, nor individual packages, should be allowed to fall as a result of the draft being tripped or the supporting gear being slackened. Today, many drafts of hazardous cargo come in unitized loads that are secured to a pallet. In general, however, it is necessary to have an adequate net or other means of surrounding the cargo on all four sides. If hazardous cargo is spilled, or if any of its containers develop a leak, employees must leave the working place. It is the employer's responsibility to assess the danger, to provide personal protective equipment and clothing, and to provide ventilation and fire protection as appropriate. The

employer must also instruct the workers in safe clean-up and disposal of a hazardous spill. This operation must be carried out under the personal supervision of a responsible employer's representative aboard the ship.

ACTIVITY 6:

1. Explain how the true gross weight of a cargo container is arrived at. _____

   _____

2. What precautions should be taken when a longshoreman is working alone in a tank or cargo compartment?

   _____

   _____

3. What is a basic rule of the longshoring industry regarding moving loads? _____

   _____

4. List three things that an employer's representative should tell employees about hazardous cargoes.

   a. _____

   b. _____

   c. _____

OBJECTIVE 7: Discuss health and safety hazards related to ventilation, sanitation, and general working conditions.

VENTILATION

When internal combustion engines exhaust into any enclosed compartment of the ship, the employer is required to make periodic tests for carbon monoxide (CO) content in the atmosphere. Tests must be carried out in the area where employees are working, by people trained in the use of test equipment and procedures. The CO content of the atmosphere is ideally maintained at not more than 50 parts per million (0.005%) at a time weighted average. When CO concentration exceeds 100 parts per million (0.01%) in the workplace,

all employees must leave the compartment. "Time weighted average" means that for any period of time in which the CO concentration exceeds 50 part per million, the concentration must be maintained for a corresponding amount of time below 50 parts per million.

Portable ventilators may be added to the standard ventilation in cases of extremely high CO concentration. A record of date, time, location, and results of tests is required by OSHA. The record must be maintained for 30 days after the completion of work and must be made available for examination by OSHA representatives.

Portable blowers are subject to the following regulations:

- Intakes and exposed belt drives must be guarded by screens.
- Frames must be grounded at the source of the current, either through a third wire in the cable that contains the circuit conductors, or through a separate wire.
- When the vessel is the source of current, ground should be made to the structure of the vessel.
- No defective electric cord should be used.

Shore-based circuits may not be used without assurance that the circuit between the ground and the grounded power conductor is of low enough resistance that there will be sufficient flow of current to cause the fuse (or circuit breaker) to interrupt the current.

Before loading grain that has been fumigated, the employer must have assurances from the elevator operator that the cargo is free from high concentrations of fumigants. Also, the employer is not permitted to load tobacco until written notice is given that it has or has not been fumigated. If a toxic fumigant was used, the employer must not begin loading without written warranty that aeration of the tobacco has made it safe for loading. This warranty must be maintained for 30 days after loading is completed, and it must be accessible for examination by OSHA. The above regulations apply equally to any other type of cargo that has been fumigated.

Employees are not admitted to any stowage space or tank until the employer ascertains (from the officer in charge of the vessel):

- Whether explosive, poisonous, noxious, or gaseous cargoes have been carried, or are stowed in such spaces.
- Whether dry ice has been used as a refrigerant.

- Whether these areas have been fumigated.
- Whether there is a possibility of oxygen deficiency.

If any of these conditions exist, the employer must evaluate the condition of the workplace in terms of employee safety. Should the atmosphere prove to be an immediate danger to life — less than 16.5% oxygen — no employee is permitted to enter or remain in the workplace until it is made safe, or unless protected by respiratory equipment. (See Figure 15.)

Figure 15. Man wearing respiratory equipment.

There are gaseous contaminants that are not immediately dangerous to life, and these can be safely breathed for short periods if necessary. Prolonged exposure is to be discouraged.

When exposed to heavy concentrations of dust, as from bulk grain, employees should be provided with respiratory equipment.

GENERAL WORKING CONDITIONS

Sanitation and drinking water regulations apply to longshoring operations. It is not permissible to perform longshoring tasks in the immediate vicinity of uncovered garbage, or in the path of overboard discharges from sanitary lines, unless protection is provided by baffles or by splash boards.

Longshoring operations in the vicinity of repair and maintenance work may encounter the interference of noise or of physical obstacles. If chipping or scaling of decks, bulkheads, and the sides of vessels creates enough noise to interfere with warnings and instructions, the operation should be halted. Work may not proceed in the hold or on deck beneath employees who are working overhead in the rigging. Overhead work creates the hazard of falling objects.

Operations must not take place where employees are exposed to injurious light rays, hot metal, or sparks, any of which can result from welding and

cutting. This regulation applies as well to sandblasting and spray painting, which can produce unsafe concentrations of dust and vapors.

First aid and life-saving equipment must be provided to longshoremen. Unless a first aid room with a qualified attendant is close at hand, the employer must furnish a first aid kit for each of his working vessels. If two or three small ships are docked together at one pier, only one kit is required. At least one employee holding a currently valid first aid certificate must be close at hand.

The kit should have a weatherproof container with individually sealed packages for each item. Basic contents required are listed below:

- Gauze roller bandages, 1 inch and 2 inch.
- Gauze compress bandages, 4 inch.
- Adhesive bandages, 1 inch.
- Ammonia inhalants and ampules.
- Antiseptic applicators or swabs.
- Eye dressing.
- Burn dressing.
- Wire or thin board splints.
- Forceps and tourniquet.

Before the kit is sent out on each job, all used items should be replaced. For each vessel, there must be available one Stokes basket stretcher or the equivalent, permanently equipped with bridles for attaching to hoisting gear. There need be no more than two stretchers on each pier, but they should be kept close to the ships.

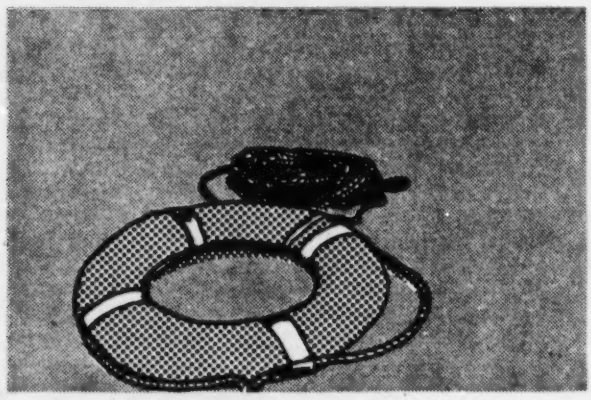

Figure 16. Life ring.

The employer must see that in the vicinity of each working vessel there is at least one U.S. Coast Guard-approved 30-inch life ring (Figure 16) with not less than 90 feet of line

attached. At least one portable or permanent ladder that will reach from the top of the apron to the surface of the water is also required. These regulations apply equally to barges, scows, lighters, log booms, and car floats alongside ships. If the life ring and lifeline are not available at the pier, the employer must furnish these items. When employees are working on log booms or cribs, lifelines should be hung overside to the water's edge.

Workers who are allowed to operate machinery must be competent by reason of training and/or experience, to the satisfaction of the employer. Such longshoremen understand signs, notices, and operating instructions, and are familiar with the signal code in use. They may operate cranes, winches, or other power-operated hoisting apparatus, as well as any power-operated vehicles. They may also give signals to the operator of any hoisting apparatus.

Employees known to have defective vision or hearing, heart disease, epilepsy, or similar ailments that are suddenly incapacitating, cannot be permitted to operate any type of power-operated hoisting apparatus, or any power-operated vehicle. Minors (under 18 years of age) may not be employed in occupations involving power-operated hoisting apparatus or even assisting in such operations.

If employers are working on longitudinal bulkheads or shifting boards (other than longitudinal bulkheads of grain feeders) at a distance of eight feet or more above any ceiling, tank, top or deck, the following regulations must apply:

- If working off a portable straight ladder, the ladder must be appropriately strong, and lashed, blocked, or otherwise secured against shifting or slipping.
- If working off staging, the lumber used in the construction must be sound, straight-grained, free from crossgrain, shakes, and large, loose, or dead knots. It must not display dry rot, large checks, worm holes or other defects which would impair its strength. Platform planking used as a work surface must not be less than 2 x 10 lumber and the width of the platform no less than 18 inches.
- In working from other elevated positions, workers must be protected from falling by a safety and lifeline.

When grain fitting operations are in progress in the square of an intermediate deck, the hatch covering must be adequate to cover the hatch, except for minimum open spaces necessary to perform the work. If coverings used to

provide a temporary work surface are other than the ship's hatch covers placed in their normal positions, they must be appropriately strong and secured against accidental dislogement.

If in the course of erecting grain fittings, employees are required to work on surfaces immediately adjacent to, or between, open deep tanks:

- The deep tank covers must be put in place.
- The opening must be covered by a net.
- The opening must be guarded by a line railing, or by a net rigged as a railing.

A grain feeder is a construction built aboard by employees to handle cargoes of bulk grain. When the hatch coverings are being removed from the interiors of feeders on completion of their construction, or if they are removed for any purpose at other times, employees must be protected from falling by the use of properly tended, individual lifelines, or by other available means. Except for the minimum work spaces necessary, hatch covers must not be removed within feeders under construction, until construction is completed. The above standards apply to repair work and to any work carried out inside an existing feeder.

ACTIVITY 7:

1. Name two situations that may require special ventilation or respiratory protection.
   a. _____
   b. _____
2. Name two types of life-saving equipment other than first aid kits.
   a. _____
   b. _____

OBJECTIVE 8: List the five types of personal protective equipment required by OSHA.

The nature of certain cargo is such that eyes may be affected by flying particles or heavy dust as the cargo is handled. Employees should be issued

eye protection equipment meeting specifications of the American National Standards (ANSI) Practice for Occupational and Educational Eye and Face Protection, Z87.1 (1979).

The eye equipment must be kept in good condition. If previously used, it should be cleaned and disinfected before another employee receives it. Those employees who wear corrective spectacles when performing eye-hazardous jobs may be protected by equipment that can be worn over personal spectacles — glasses with prescription-ground safety lenses are permissible in lieu of cover goggles, as long as such glasses provide suitable protection against the specific hazard involved.

Respiratory protective equipment required in this section must carry U.S. Bureau of Mines approval for the use intended. Exceptions are: protection against pneumoconiosis-producing dusts that requires a respirator fitted with the type of filter appropriate for such dusts, and "nuisance" dusts that require a similar filter, or a suitable dust mesh.

Protective clothing is essential for employees handling cargo that may rupture, leak, or spill. Since such mishaps can result in skin irritations and burns, the workers should be provided with chemical-proof clothing. Protective gear that has previously been worn must be cleaned and disinfected before being reissued to another employee.

For protection of the feet, employees should be encouraged to wear safety shoes. Sneakers and sandals are inappropriate for waterfront operations.

Head protection is imperative for employees in situations where tools and pieces of equipment may fall from above. Hats must meet the specifications of the American National Standards Safety Requirements for Industrial Head Protection, Z89.1 (1969). Previously-worn hats are to be cleaned and disinfected before reissuance to another employee.

For protection against drowning, personal flotation devices (PFDs) should be available to employees. Such a device must be approved by the U.S. Coast Guard as a Type I PFD (Personal Flotation Device), Type II PFD, Type III PFD, or Type V PFD (or their equivalent), pursuant to 46 CFR Part 160 (Coast Guard Life-Saving Equipment Specifications), and 33 CFR 175.23 (Coast Guard table of devices equivalent to personal flotation devices).

PFDs must be worn by:

- Employees working on log booms.
- Employees walking or working on the decks of Mississippi River barges.
- Employees walking or working on the decks of Gulf Intracoastal Waterway barges.

Personal flotation devices must be well cared for. They are considered unserviceable upon loss of buoyancy or when their fastenings have become unsafe.

ACTIVITY 8:

Name two circumstances in which employees are required to wear PFDs.

1. _____
2. _____

REFERENCES

American National Standards Institute. Practice for Occupational and Educational Eye and Face Protection, ANSI Z87.1. New York: American National Standards Institute, 1979.

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ANSWERS TO ACTIVITIES

ACTIVITY 1

1. a. Gangway.
   b. Straight ladder.
   c. Jacob's ladder.
2. As cargo is loaded or unloaded, the ship will rise or fall, causing the gangway to shift.
3. d. Cargo may never be used as a means of access.

ACTIVITY 2

Any three of the following:

1. Illumination.
2. Accumulation of ice.
3. Accumulation of dunnage.
4. Protruding nails.
5. Gear and equipment not in use.

ACTIVITY 3

1. b. Support, guarding, and clearance.
2. They must be arranged in piles no closer than three feet from hatch coaming; no higher than the coaming, unless spread one-high between coaming and rail and with at least 24 inches of height of hatch; if deck area is too narrow, may be stored more than one-high as long as 24-inch height of hatch is maintained on working side of ship. (Any two.)

ACTIVITY 4

1. One continuous piece without a splice.
2. Clamps, U-bolts, or shackles.
3. Should be secured in neutral.
4. The tension on each fall.

ACTIVITY 5

1. True.
2. False.
3. True.
4. True.
5. True.
6. True.

ACTIVITY 6

1. The sum of its weight when empty + the maximum cargo weight it is intended to carry + the sum of the above two weights.
2. Constant checks must be made by other workers.
3. Loads are not to be hoisted over exposed employees, and employees are never to stand under a load.
4. a. The nature of the dangerous cargo.
   b. The nature of the hazard the cargo presents.
   c. The special precautions that must be taken.

ACTIVITY 7

1. a. Where there is high CO concentration from running engines.
   b. Where there are heavy concentrations of dust, as in bulk grain loading.
2. a. A stokes basket stretcher or equivalent.
   b. A U.S. Coast Guard-approved 30-inch life ring with 90 feet of line.
   c. A personal lifeline.

ACTIVITY 8

Any two of the following:

1. Employees working on log booms.
2. Employees walking/working on the decks of Mississippi River barges.
3. Employees walking/working on decks of Gulf Intracoastal Waterway barges.